ELEC-E8422 An Introduction to Electric Energy

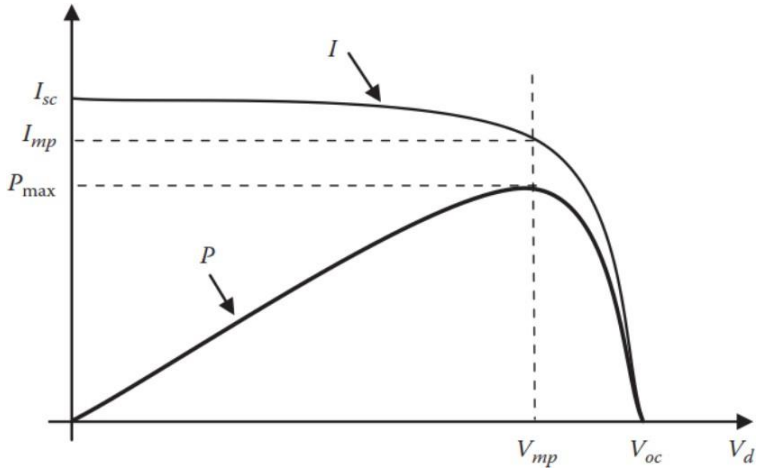
Homework 3: Solar Energy

Solar cells are having maximum power point.

a) Explain shortly what is behind this, i.e. why it exists.
b) What kind of consequences this has when using the cells in electricity production?
c) How are you connecting solar cells into the existing ac power system?

Solution of Homework 3

a) V-I characteristics of a solar cell can be illustrated as below.




As can be seen from the above characteristics, there is a point at which the power is maximum for a specific voltage and a current value. If the cell operates at these specific values, the maximum power can be reached.

b) Since the maximum power occurs at the specific values of voltage and current, there is a need for a variable resistor or a converter which adjust the system so that it operates at maximum power point.

c) Solar cells generate a DC voltage. However, this DC voltage should be converted to an AC voltage for connecting to the grid. Therefore, we need usually a DC-DC converter and a DC-AC inverter for converting the output voltage of PV cells to the AC voltage. After that, we should use an LCL filter for reducing the harmonics in voltage and current. Finally, a transformer should be used to step up the voltage value to the distribution grid voltage level.